

A Preliminary Assessment of Development Impacts on the Peatlands of the Kenai Peninsula and a Methodology for the Estimating Peatlands Carbon: A North Fork Watershed Case Study

Final Internship Report Executive Summary
Professional Science Master's (PSM) in Environmental Sciences
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This internship was conducted remotely with the Alaska Region of the U.S. Fish and Wildlife Service (FWS). Presented here is a case study on the lowland peatlands of the North Fork watershed of the Anchor River on the Kenai Peninsula of Alaska (Fig. 1). The aim of this work and study was to develop preliminary and exploratory methods to quantify the existing conditions, the rate of change, and the future potential change of the peatlands in this watershed. In collaboration with Kachemak Bay National Estuarine Research Reserve (KBNERR), FWS hopes to find a solution for the long-term conservation of the peatlands of the Kenai Peninsula, by exploring different avenues to do so, including a feasibility assessment for a

carbon project.

Peatlands contain large amounts of carbon sequestered in their soils due to their unique ability of anoxically decomposing organic material in saturated conditions slowly over thousands of years (Loisel and Yu 2013, Strack et al. 2008, Wang et al. 2016, Turunen et al. 2002). If drained, developed, burned, or otherwise degraded, peatlands can emit stores of carbon into the atmosphere, contributing

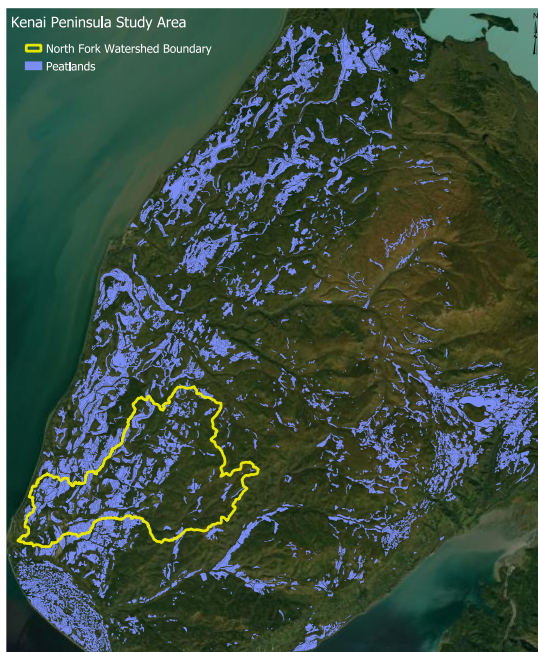


Figure 1: A map of the peatlands and the North Fork watershed of the Anchor River boundary

to greenhouse gas emissions and exacerbating climate change (Potter et al. 2006, Gatland et al. 2014, Kroeger et al. 2017). Other than the ability to sequester carbon, peatlands provide many other ecosystem services such as supporting biodiversity, flood control and water storage, providing a source of dissolved organic carbon for stream productivity (Agren et al. 2008). In addition, peatlands are an important source of cool water for headwater streams that support juvenile salmon-rearing habitat (Freeman et al. 1994), which in turn support subsistence hunting, recreation, tourism, and overall stream and ecosystem health (HSWD 2014).

The aim of this work with the FWS and KBNERR is to assess the viability of a carbon project by researching and developing the methodological steps needed to be taken. A carbon project is defined as the initial stage and process of assessing the potential carbon stored in a landscape that could be marketed as carbon credits for trade on the world carbon market. A carbon project can have many outcomes, including the conservation of a landscape or changing behavior and development decisions. This internship was developed to help FWS develop the methodological steps to determine feasibility of a carbon project on the Kenai Peninsula of Alaska.

The methods I explored for the quantification of existing peatland conditions utilized GIS applications and the Natural Resources Conservation District's Web Soil Survey. These tools helped me gather the data needed to approximate the carbon content in the soil of the North Fork watershed of the Anchor River. Using depth ranges, area, bulk density and soil organic carbon values, I was able to find a preliminary estimation of the soil's carbon content. Further calculations were made to estimate the conversion of carbon into carbon dioxide emissions. The second section of the internship focused on finding ways to quantify the rate of change,

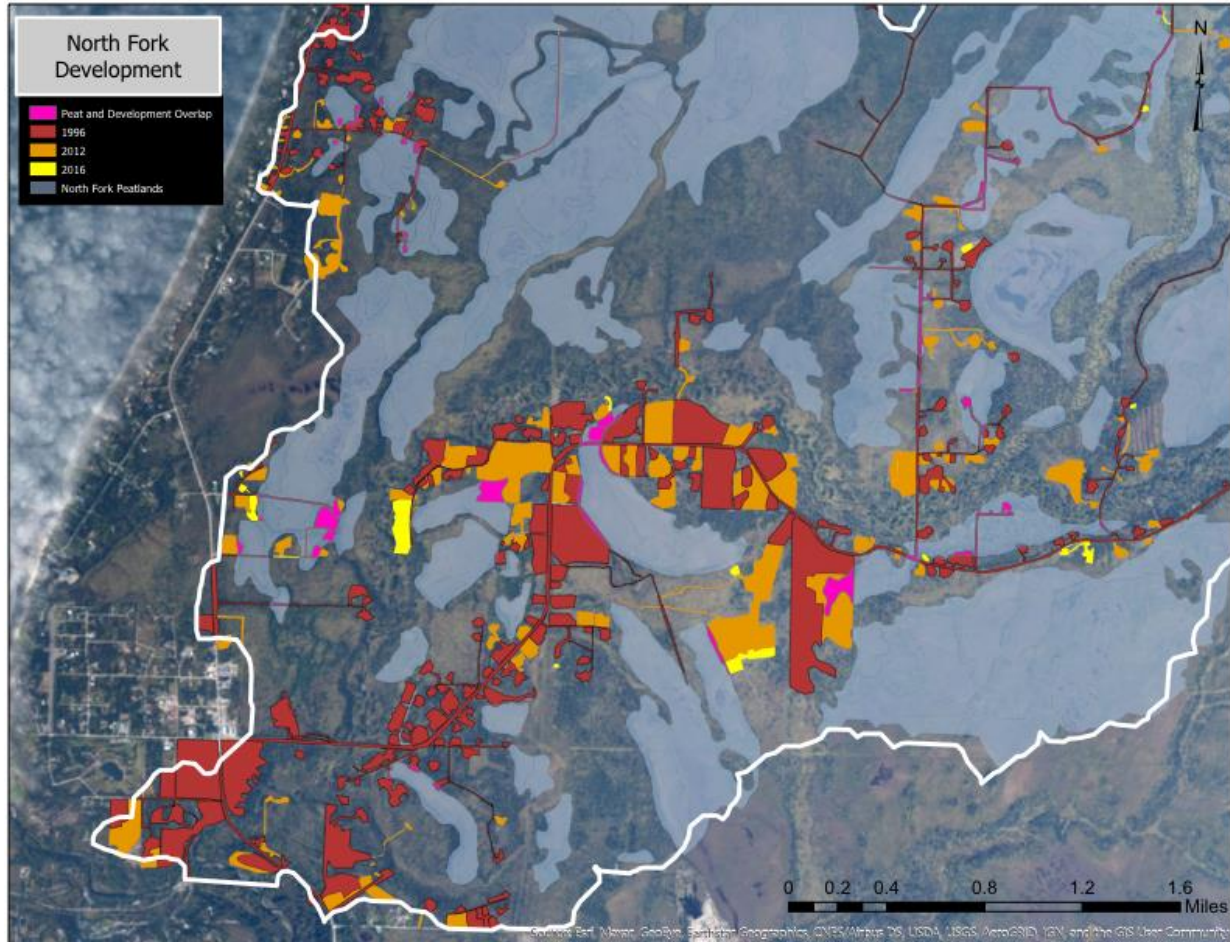


Figure 2: A map of digitized development over a span of 20 years and peatland location on the Kenai Peninsula, Alaska.

specifically development in the North Fork. I explored two methods, using National Land Cover Database raster data from the years 2001, 2011, and 2016, and using aerial imagery from the years 1996, 2012, and 2016 and manually digitizing land use and development (Fig. 2). Each method yielded a different rate of change, but the aerial imagery was preferred due to its higher precision, despite the time it took to manually digitize development. Other comparative methods of change were investigated, including rate of material site (gravel mine) expansion, and the rate of development encroachment on peatlands. This revealed that development was occurring at a rate of 120 hectares per year, that gravel mines were expanding at 3 hectares per year, and that peatlands were being encroached upon by development at a rate of 0.77

hectares per year. Finally, to quantify future potential loss, I assessed the overlap of peatlands and gravel mine parcels using GIS. This showed how many hectares of peatlands were within the boundaries of potential excavation. These methods serve as investigative exercises and demonstrate potential research options intended to be built upon for future projects.

The business section of the report emphasizes how the Alaskan Region of FWS's resource protection and long-term conservation goals can be achieved through partnership and joint-project endeavors that work beneficially towards a common purpose. The mission of the Alaska Region of the FWS, a federal agency, is to conserve, protect, and improve plant, fish, and wildlife habitat for the people of the United States. They hope to uphold their goals of long-term conservation by exploring creative resource preservation options through a carbon project. Funding for such projects and grants come from yearly federal budget monies that depend on appropriations for resource management and totaled \$70 million in 2020 (Department of the Interior 2021). The Partners for Fish and Wildlife (PFW) program and the Coastal Program (CP), both of which fall under the umbrella of Habitat Conservation within FWS, are the divisions under which this collaboration with KBNERR and research are being conducted. The PFW and the CP work with local communities on concerns and conservation challenges in those areas to conserve land for future generations and to support and bolster natural populations and habitat and use this funding to do so. Allocated funds are granted to partnering agencies, such as KBNERR, and helped to advance this project by funding KBNERR's research plan development, data collection, and communication and outreach. The management of my internship was conducted by Mary Colligan, former Assistant Regional Director of Fisheries and Ecological Services at FWS, then by Mike Daigneault, after her

retirement, who is supervisor and coordinator of the Habitat Restoration and Partnership Programs and Regional Coordinator of the Coastal Program Grant. Management of the research and data collection of this project is led by KBNERR's manager, Coowe Walker, and her staff.

In conclusion, the methods and research I contributed from this internship will serve as the groundwork for the next phase of research and data gathering for this project. My efforts identified major data gaps and future work possibilities for this work. Skills that I gained from this internship include GIS analysis in real world applications, Excel analysis, and research and critical thinking. After completing this project, I found a new passion for climate work and hope to bring these skills to a position working in climate science one day. The challenging material presented to me throughout this internship helped me hone my analytical, motivational, and organizational abilities, and contributed overall to my confidence in taking the next step in my career. Not only did this internship help me to succeed in obtaining employment with the County of Boulder Parks and Open Space working on conservation easements and fulfilling my passion for environmental conservation, but it also helped to pave the way for future student opportunities within the FWS.

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